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D6.1.4. Evaluation of safe technology

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Revision 1.0

Dissemination level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Contents

1. INTRODUCTION

1.1. Scope of Work

This report documents the results of the final evaluation of safe technology. The primary aim of this deliverable is to document the improvements for ensuring diver safety by building a regulatory framework for the acceptance of robotics in the diver community. The secondary aim is to address "perceived safety" as an important factor of acceptance and functionality as well.

1.2. Liability Disclaimer

The analysis compiled in this report are prepared for the vehicle list provided by the project partners, and cannot be used as a general guideline for other submersible AUV's or Robot operations. The analysis is based on the design documents provided by the partners and they are partially validated during open water functionality tests.

2. FORMAL RISK ASSESMENT on EXISTING VEHICLES

2.1. Background

The risk assessment is performed based on the quantification described at deliverable 6.1.1 page 12 using the hazards of man-machine interaction described in the section 2.2 of the deliverable 6.1.1. namely:

a. Trauma
b. Electrical shock
c. Acoustical trauma
d. EM hazards

The system and procedures were modified to decrease the risks to an acceptable level as documented in D.6.1.4. These efforts are continued in the last year.

2.2. Risk assessment on Trauma

Several Risk Mitigation techniques were used for decreasing the Trauma risk. As a consequence the risk values in the parameters are shifted to ALARP (As low as reasonably practicable) levels by design and procedural modification. The haptic kill switch that was not built at the stage of D6.1.3 was made operational and tested before the trials.

2.3. Risk assessment on Electrical Shock, Acoustical Trauma and EM hazards

There are no changes in the risk assessment of the acoustical trauma, electrical shock and EM hazards and they are still at acceptable level for all vehicles as described in the previous deliverable (D.6.1.2).

3. IMPROVEMENTS on SAFETY

The suggestions on the improvements of safety are followed by the consortium; and the risks dropped to an acceptable level for almost all vehicles for all potential hazards.

According to the above risk analysis, there is one vehicle that is still on the high risk category for trauma (SeaMor 300F - ROV). The use of this vehicle in the vicinity of divers is avoided because the kill switches and propeller guards are not yet installed. To reduce the risk of trauma from BUDDY vehicle, its speed is to limited to 0,5 knots. The efficiency of kill switches and electrical systems were tested before putting the divers in the vicinity of the vehicles during the validation trial using the "CADDY – Device checklists" presented at D6.1.3. No accident and no incident were observed during the 3rd year.

4. PERCEIVED SAFETY of CADDY

The perception of safety is an important factor in diving. It influences the diving behaviour and in extreme cases degraded safety perception might contribute to the root cause of the accidents. DANEU performed a survey on the safety perception of divers. The participation was at a very high level (3766 in EU region, 4072 in total). According to the results of this survey, equipment malfunction is the highest concern of the diver.

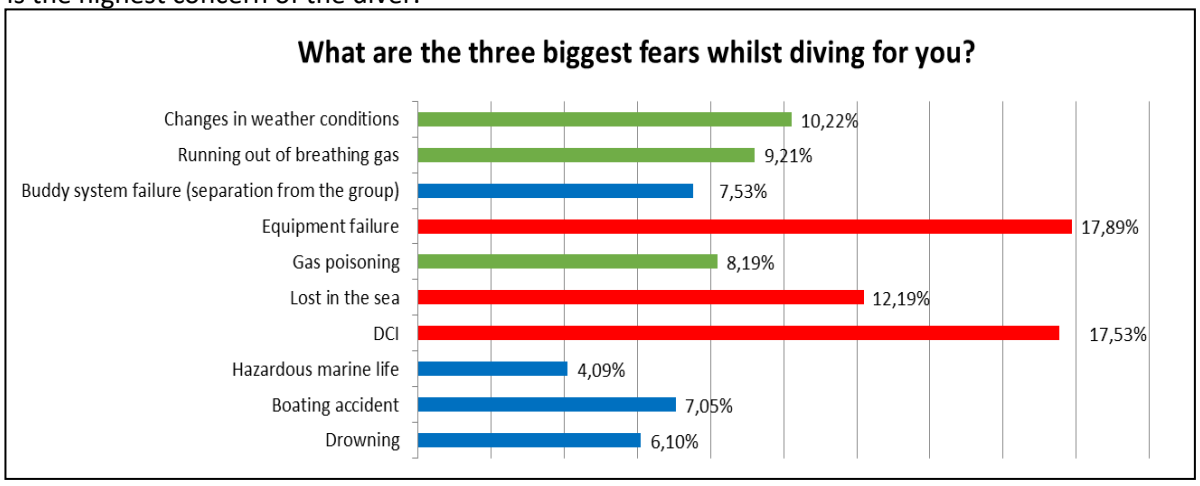

Fig 1. The highest fears of divers according to the survey (N=4072).

The results of survey bring the necessity of diver's confidence build up with any equipment introduced in the diving industry. That requires adequate briefing divers on CADDY's functionalities, safety checks, the use of kill switches and the risk assessment background. This approach was adopted in the final validation trials and the efficiency is assessed using the corresponding questions of the survey addressed to the dives (D.5.3, Annex A). The end users confirmed that all safety concerns were properly addressed as seen from all answers in the safety validation questioner are positive.